

Reach for the Stars – Answer Key

Team #: _____

Team Name: _____

- Please write you team name and number on your answer sheet.
- 12 stations – 3.5 min per station
- Review time at last station (remaining min)
- Answers must be legible. 1 point for each correct answer (109 points total)

Station 1	8 Points
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1. New Generation Catalogue
2. A. parsec
B. Parallax of one arcsecond
3. A. 1 AU is roughly the distance from Earth to the Sun.
B. 8 minutes (or 8.31675 minutes)
4. 149,597,870,700 m (about 150 M km, or 93 M miles)
5. 63241.1 AU
6. 1990 – 51 (Castor is 51 light years away) = 1939

Station 2 - Identify Constellation Set 1	4 Points
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7. Cassiopeia
8. A: Cygnus
B: Almost exactly overhead
C: Milky Way Galaxy

Station 2 - Identify Constellation Set 2	2 Points
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9. Dorado
10. Tucana

Station 2 - Identify Constellation Set 3	2 Points
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11. Serpens
12. Sagittarius

Station 3 - Identify Star - Set 1	4 Points
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13. A: Arcturus
B: Alpha Boötis (α Boötis, abbreviated Alpha Boo, α Boo)
14. A: Procyon
B: Alpha Canis Minoris (α Canis Minoris, abbreviated Alpha CMi, α CMi)

Station 3 - Identify Star - Set 2	4 Points
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15. A: Deneb
B: Alpha Cygni (α Cygni, abbreviated Alpha Cyg, α Cyg),
16. A: Pollux
B: Beta Geminorum (β Geminorum, abbreviated Beta Gem, β Gem)

Station 3 - Identify Star - Set 3	2 Points
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17. Regulus or Alpha Leonis (α Leonis, abbreviated Alpha Leo, α Leo)
18. Alcor or Mizar

Station 4 – Deep Sky Objects - Set 1	6 Points
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19. NGC 7293 or Helix Nebula
20. Left: Optical
21. Right: Infrared
22. M57 or Ring Nebula
23. Red Giant
24. White dwarf

Station 5 – Deep Sky Objects - Set 1	4 Points
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25. NGC 3603
26. Carina
27. No – This DSO is visible in southern hemisphere
28. Hydrogen (or H or HII – accept these answers too)

Station 5 – Deep Sky Objects - Set 2	4 Points
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29. Cassiopeia A (or Cas A) SNR (Source – Smithsonian 3D model)
30. Correct answer is M or W. The constellation is Cassiopeia.
31. FeK (Chandra Telescope) - The green portions of this model represent radiation from the element iron as seen in X-ray light from Chandra. Iron is forged in the very core of the star but ends up on the outside of the expanding ring of debris.
32. Fiducial Jets - In purple, two jets of material are seen. These jets funnel material and energy during and after the explosion. They mostly contain Silicon.

Station 5 – Deep Sky Objects - Set 3	3 Points
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33. 30 Dorado or Tarantula Nebula
34. Large Magellanic Cloud (LMC)
35. Either answer acceptable - Star cluster NGC 2070 (or Caldwell 103)) which includes the compact concentration of stars known as R136 (or RMC 136).

Station 6 – Star Classification**15 Points**

- 36. T – White dwarfs which remain after supernova
- 37. Q, R, S – Main sequence stars
- 38. P
- 39. P
- 40. b
- 41. T
- 42. S
- 43. a
- 44. A – Red Dwarfs
B – Super Red Giant
C- Red Giants
D- Main Sequence
E – White Dwarf
- 45. Lines of constant radius - Radius of the stars as compared to Sun's radius
- 46. They all have very similar radius

Station 7 – Astronomical Spectroscopy**8 Points**

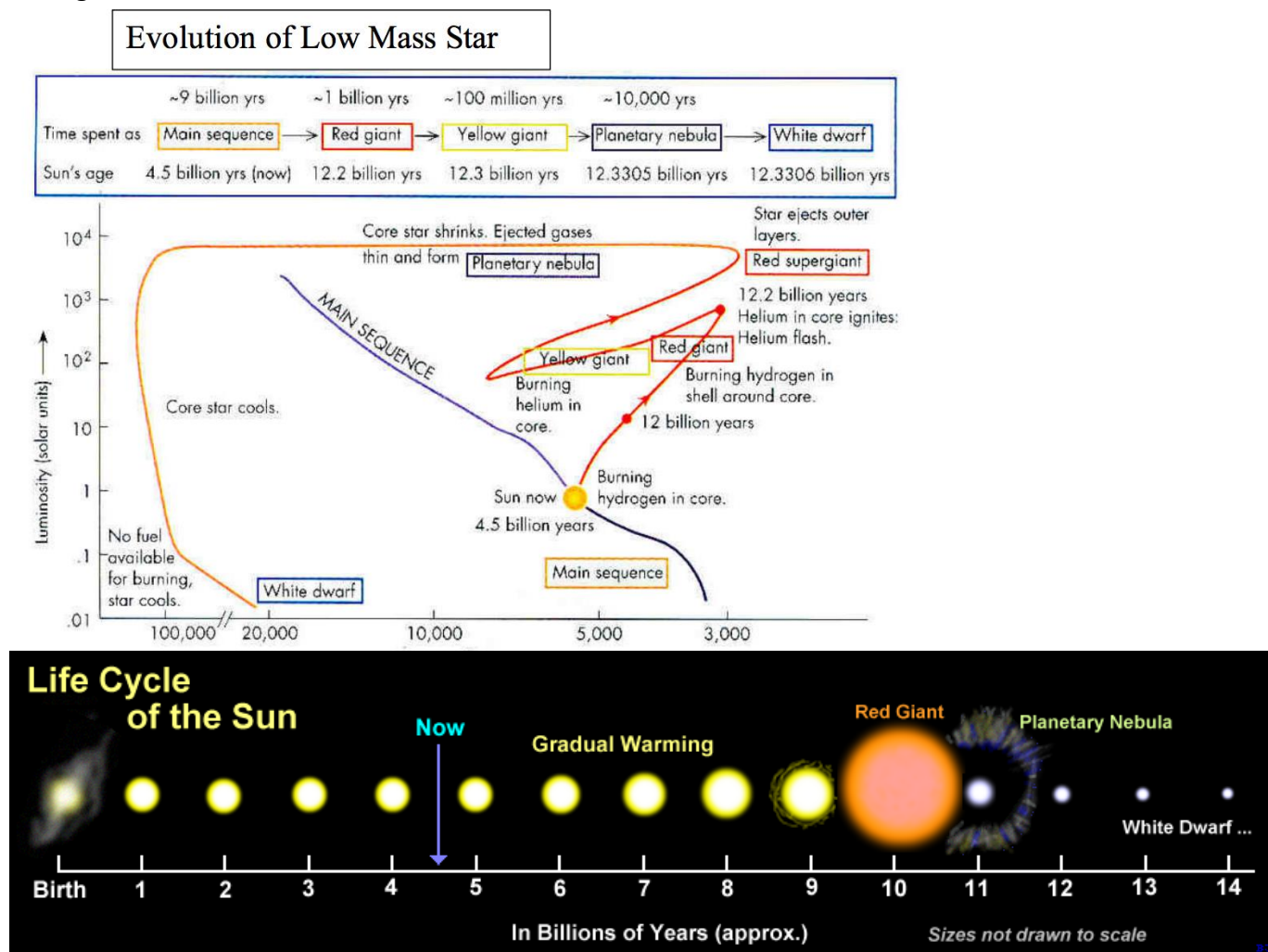
- 47. M16 or Eagle Nebula
- 48. A. Composite of Optical and X-Ray
B. Infrared
C. Optical
D. For i, ii, iii - Any 3 out of
chemical composition, temperature, density, mass, distance, luminosity, and relative motion using Doppler shift measurements
- 49. EGG - Evaporating gaseous globules

Station 8 – Stellar Evolution 1**10 Points**

- 50. Protostar
- 51. Main Sequence
- 52. Super Giant
- 53. Red Giant
- 54. Planetary Nebula
- 55. White Dwarf
- 56. Black Dwarf
- 57. Supernova
- 58. Neutron Star
- 59. Black Hole

Station 9 – Stellar Evolution 2**11 Points**

60. See figure below



1 point – for diagram

Star phase	Points	Time spent	Points
Main sequence	1	9 billion years	1
Red Giant	1	1 billion years	1
Yellow giant to Red supergiant	1	100 million years	1
Planetary Nebula	1	10,000 years	1
White dwarf	1	Unknown	1

Station 10 – General Questions 1**7 Points**

61. Absolute Magnitude - “true brightness” – brightness as seen from 10 parsecs (32.6 light years)
 62. Apparent Magnitude - the brightness of object as seen from the viewer’s viewpoint (Earth)
 63. Absolute Bolometric Magnitude - Brightness at ALL wavelengths (from 10 pc).
 64. distance modulus
 65. A: Luminosity – Watts
 B: Flux – Watts / m²
 66. The Sun appears brighter than Sirius (Doh!).

Station 11 – General Questions 2**8 Points**

67. A: Absolute
 B: Apparent
 68. A: Distance 62.5 pc or 203.85 Light years
 B: Absolute Magnitude or $M_v = 2$

$$d = 1/p = 1/0.016'' = 62.5 \text{ pc}$$

If $d = 63 \text{ pc}$ then the Distance Moduli table tells us $m_v - M_v = 4$.

Recall $m_v = 6$, so $6 - M_v = 4$
 $M_v = 2$

$m_v - M_v$	$d \text{ (pc)}$
0	10
1	16
2	25
3	40
4	63
5	100
6	160
7	250
8	400
9	630
10	1000
11	1600
12	2500

69. Binary stars
 70. Q1: A
 Q2: C
 Q3: C

Station 12 – General Questions 3**7 Points**

71. Chandrasekhar limit
 72. Type 1 A
 73. A Brown Dwarf
 74. By studying its orbit around a binary companion
 75. Star B is closer to earth than Star A.
 76. Nuclear Fusion
 77. It doesn’t – White dwarfs DO NOT produce energy